WRIGHT-PATTERSON AIR FORCE BASE, AREA B, BUILDING 20A, PROPELLER WHIRL RIGS ACOUSTICAL ENCLOSURE
DAYTON VIC. Propeller Test Complex
GREENE COUNTY
OHIO

HAER No. OH-79-C

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

WRIGHT-PATTERSON AIR FORCE BASE, AREA B, BUILDING 20A, PROPELLER WHIRL RIGS ACOUSTICAL ENCLOSURE

HAER No. OH-79-C

Location: 7th Street from E to G Streets; Wright-Patterson Air Force Base, Area B, Dayton Vicinity, Greene County, Ohio.

Dates of Construction: 1927, 1944.

Engineers: Allen and Kelley, Indianapolis, IN.
U.S. Army Corps of Engineers, Wright Field District Office.

Construction Contractors: A. Farnell Blair, Decatur, GA.
Price Brothers, Dayton, OH.

Present Owner: USAF.

Present Use: Compressor Research Test Facility.

Significance: This concrete acoustical structure was built during World War II to surround an outdoor propeller test area and craneway. The unique concrete tube construction was a response to the need to muffle the noise of propeller tests while allowing a free flow of air, and the war-related shortage of many building materials.

Project History: This report is part of the overall Wright-Patterson Air Force Base, Area B documentation project conducted by HAER 1991-1993. See overview report, HAER No. OH-79, for a complete description of the project.

DESCRIPTION: The Propeller Test Complex is a rectangular, cast-in-place concrete building with nineteen open-sided bays. The 24' thick walls are a combination of solid concrete and acoustical baffles of honeycomb construction. The baffles are tubes of 3½"-thick pre-cast concrete which is so porous that it allows smoke to blow through the walls of the tube. Four baffles, 6' long and 2' square are laid end to end, angled slightly upward from both sides towards the center of the wall to increase their muffling effect. The baffles are now enclosed with glass. The roof is constructed of 3" planks on wood trusses, covered by a 3" slab of lightweight aggregate concrete. The floor is the original concrete base which supported the rigs before they were enclosed. The interior of the complex contains four propeller test whirl rigs built by Westinghouse Corporation, a craneway, and wooden baffling pads called bombproofs.

HISTORY: The Propeller Test complex is a system of structures designed to test the structural integrity of aircraft propellers. The heart of the complex is the line of three propeller test rigs, built by the Westinghouse Corporation to the specifications of Wright Field personnel M.A. Smith and Adam Dickey. The first was completed in 1929 and the other two in 1931. Operating at 6000, 3000, and 2500 horsepower, these rigs were originally designed to turn propellers at respective speeds of 750, 1800, and 3600 revolutions per minute. (The high horsepower rigs operated large propellers, which revolved at slower speeds than small propellers.) Typically, an endurance test of twenty hours was followed by an overspeed test at 110 per cent of maximum speed to prove the propeller's strength.

Originally the three test stands stood out in the open. A 40-ton overhead crane was built to assist in the construction of the rigs and to lift experimental equipment and propellers into place. Thick wooden structures called bombproofs or bombpads were constructed next to and above the test rigs to restrict the flight of propeller fragments after failure on the rigs.

A concrete acoustical structure surrounding the test area and craneway was constructed during World War II when the continuous testing of propellers created a thunderous drone so powerful that it was considered a health hazard. The engineers faced the challenge of designing an enclosure which would muffle the noise of the propellers while still allowing free circulation of air so as not to affect the test results. Such a structure had never been built before and, in addition, war-related shortages limited the diversity of available materials. Engineers solved the problem by building walls of square tubes, 6' long and 2' square, of a concrete sufficiently porous to allow air to pass through. To

create the 24'-thick walls, four tubes were laid end-to-end with an upward tilt in the middle, designed to break up and dampen the sonic pulses produced by the whirl rigs. The architecture-engineering firm that devised this arrangement was Allen and Kelley, of Indianapolis, Indiana, under the direction of the Wright Field District Office of U.S. Army Corps of Engineers. A. Farnell Blair, of Decatur, Georgia, was the contractor, and Price Brothers, of Dayton, fabricated and set in place the precast concrete tubes.

In the early 1950s a fourth test rig was constructed, which was capable of a 30,000 horsepower drive output at variable speeds up to 12,000 r.p.m.

From 1929 to 1965 these rigs were used for testing propellers, propeller hubs and controls. Testing was done on a range of materials, including wood, laminates, composites and stainless steel, and on a range of propellers, including supersonic and turbo-prop aircraft propellers.

The Compressor Research Test Facility was constructed on the site between 1975 and 1981, consisting of a 30,000 horsepower variable speed drive system, that allowed speeds of up to 16,000 r.p.m. at 30,000 horsepower and up to 30,000 r.p.m. at 15,000 horsepower. The facility is designed to provide performance test data on new and existing jet engine compressors. It also includes a test chamber with test air flow straighteners and an altitude controllable inlet system, a test air exhaust system and a computerized data acquisition system.

For bibliography, see Wright-Patterson Air Force Base overview report (HAER No. OH-79).